

ATTACHMENT NO. 3

SPECIFICATION FOR THE FISCHER-PORTER/BELFORT

PRECIPITATION GAUGE ELECTRONIC SENSOR UPGRADE

SPECIFICATION NO. D111-4A1-SD001

APRIL 2000

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FISCHER AND PORTER/BELFORT PRECIPITATION GAUGE
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U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
National Weather Service
Engineering Design Branch, W/OS031
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Silver Spring, MD 20910-3283

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1.0 INTRODUCTION

The National Weather Service (NWS) operates and maintains a network of 2,700 recording rain gauges at locations throughout the 50 United States. These gauges are Fischer and Porter/Belfort (F&P) models 35-1558 and 35-1559. These gauges record precipitation accumulation amounts, at 15 minute intervals, on a punched paper tape. The NWS desires to discontinue use of punched paper tape to record precipitation data from these gauges, and is seeking an electronic storage media to perform this function. The NWS will retain the use of the weighing mechanism of the gauge, replacing only the paper tape punch mechanism.

2.0 APPLICABLE DOCUMENTS

In the event of conflict between the documents referenced herein and the contents of this specification, the contents of this specification shall govern.

2.1 Government Documents

The issue in effect on the date of issue of the solicitation of the following documents form a part of this specification to the extent specified herein.

2.1.2 Standards

MIL-STD-810E	Test Method Standard for Environmental Engineering Considerations and Laboratory Test
MIL-HDBK-217	Reliability Stress and Failure Rate Data for Electronic Equipment
WS-STD-2	NWS Standard Environmental Criteria and Test Procedures
(no number)	NWS Transient Susceptibility Standard
FCM-S4-1994	Federal Standard for Siting Meteorological Sensors at Airports
WSOM B-11	Weather Service Operations Manual (WSOM), Chapter B-11, Standards and Procedures for Surface Observations Program

2.2 Non-Government Documents

The following documents form a part of this specification to the extent specified herein. Unless otherwise indicated the issue in effect on date of issue of the solicitation shall apply.

NFPA 70 National Electric Code

2.3 Source of Documents

Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the following addresses:

NWS Standard Environmental Criteria and Test procedures and NWS Transient Susceptibility Standard may be obtained from:

National Weather Service
Attn: David Desrosiers, OS031
1325 East West Highway, SSMC2#3160
Silver Spring, MD 20910-3283

Weather Service Operations Manual, Chapter B-11, can be obtained on the Internet at:

<http://wsom.nws.noaa.gov/>

or it may be obtained from:

National Weather Service
Attn: B. Dodds, W/MB32
1325 East West Highway, SSMC2#18456
Silver Spring, MD 20910-3283

National Fire Protection Association (NFPA) documentation can be obtained from:

National Fire Protection Association
Custodian of Documents
470 Atlantic Avenue
Boston, MA 02210

Applications for copies of military documents should be addressed to:

Standardization Document Order Desk
Bldg. 4D
700 Robbins Avenue
Philadelphia, PA 19111-5094

2.4 Statement on Military and Other Specifications

It is the intent of the Government to procure equipment of the highest quality which maximizes the use of commercially available equipment. Military and other specifications quoted in this document shall apply to all equipment, documentation and items delivered under this contract unless the Government provides the Contractor with a written waiver. The Government will consider waiving a particular specification or portion thereof, only if the Contractor can show that the equipment, documentation or delivered item is in compliance with an equivalent standard or specification, and the Contractor can demonstrate that the equivalent item is in compliance with the performance requirements of this specification.

3.0 SYSTEM REQUIREMENTS

3.1 System Description

The replacement recording system, referred to as the gauge modification assembly (GMA), is required to: sense, convert and record precipitation data at 15 minute intervals; maintain a non-volatile record of the data sufficient to support monthly retrieval; allow operator notations to indicate changes due to emptying the gauge or other maintenance; provide a non-volatile removable electronic memory transport module; display the amount of captured precipitation in inches of liquid water; be powered by a 12 volt battery with solar recharging; and support field installation, calibration, and maintenance by an NWS technician.

The NWS will perform real time comparative testing of the GMA to verify meteorological and operational performance. To support the test effort, NWS will acquire a small number of remotely-located, wireless, display and communication (DCOM) units capable of collecting and reporting the GMA data to a human observer and transmitting the data via telephone modem to a remote host computer. The GMA is required to support the addition of the DCOM for monitoring purposes, but the GMA shall not require the presence of a DCOM for full and complete operation. (For distinction within this document the DCOM is labeled as optional.)

The GMA shall perform all data collection (with the exception of the observer-entered data), data processing, data transmission, data archiving, operator display updates, system self-testing, and output generation without attendance of an operator. The DCOM shall update its display and control the telephone modem interface to send or receive data from a remote data collection computer without attendance of a local operator.

The GMA shall be installed in or with the F&P gauge, and provide the sensor, mounting hardware and cabling to interface with and sense the motion of the weighing mechanism of the F&P gauge. The GMA shall provide interfaces and control for the new F&P sensor, and other analog or digital sensors. The GMA shall provide an operator input capability for a limited

number of pre-defined operating notations (e.g., added oil, reset gauge, etc.), and be programmable to collect, convert, and store automated measurements from the new F&P sensor, and other sensors (e.g. temperature sensor, and shaft encoder).

3.2 Gauge Modification Assembly (GMA)

The GMA shall include all hardware and software necessary to generate, convert, collect, store and transport data from the F&P gauge. In addition, the GMA shall also support the above operations for the following separately supplied sensors common to NWS weather stations: an air temperature sensor, and a stream gauging shaft encoder. Each sensor is described in a following section.

3.2.1 Installation, Location and Size

Parts of the GMA shall be installed within the lower case of the F&P, and the remainder externally on a pole.

3.2.1.1 Installation

The GMA shall be field installable by technicians using only Contractor-provided document-action and specified tools. Inside the F&P, the GMA shall use existing mounting holes, brackets, and attachments, or it shall clamp to existing structures for support. Wire runs to the outside shall use existing wire ports in the base that are tapped for ½" NTPI conduit or wire strain relief fittings. Any portion of the GMA that cannot be installed within the F&P (e.g., solar panel, optional wireless link antenna, etc.) shall be weather resistant and shall mount on a single 2 - 3 inch dia, galvanized metal pole.

3.2.1.2 Display Location

Any visual operator indicators shall be viewable through the opened door of the F&P lower case, or through a window or opened door of a pole-mounted enclosure.

3.2.1.3 Internal Free Space

The F&P gauge is a commercial item and the Government does not have drawings of the internal spaces available within the housings. The Government recommends that an actual gauge be inspected and measured by the contractor before submission of any proposal. A gauge is available for inspection at NWS

headquarters in Silver Spring, MD. Arrangements to see this gauge may be made through the Contract Specialist Eleanor Kaul at 301/713-0823 x142 or via email at Eleanor.E.Kaul@aqf.noaa.gov. The following paragraph provides a summary of the space available within the gauge.

The weighing mechanism is mounted on a raised platform within the lower case of the F&P. Free space is available on each side of the weighing mechanism with the approximate dimensions, 8"w X 3"d X 15"h or 6"w X 4.5"d X 15"h due to the curvature of the case. Removal of the punched tape mechanism will result in free space above the platform, adjacent to the movable end of the weighing mechanism, with the approximate dimensions, 11"w X 5"d X 10"h or 7"w X 6"d X 10"h due to the curvature of the case. Removal of the tape supply spool and bracket will result in free space below the platform, between two support legs of the platform, located at the door in the lower case, with the approximate dimensions, 8.5"w X 6.5"d X 4.5"h. The area below the platform, under the weighing mechanism, between the third leg of the platform and the dash pot, bounded by the tall vertical spaces on each side of the weighing mechanism, has the approximate dimensions 6.5"w X 5.5"d X 4.5"H.

3.2.1.4 Siting Restrictions

The addition of a GMA to the F&P shall not violate siting requirements of the F&P gauge as defined in the meteorological siting standards, FCM-S4-1994 and WSOM B-11. The GMA shall be restricted in both size and location. If GMA components are installed outside the F&P lower case they shall not be taller than 12 inches below the orifice of the gauge within 10 feet of the gauge, and the components shall not form a wind fence that shields the gauge, or allows snow to collect and shield, or bridge to the gauge.

3.2.2 Precipitation Sensor

The precipitation sensor (PS) shall be provided with, or as part of the GMA. The GMA shall provide all support and meet all interfacing requirements for the sensor if required.

3.2.2.1 Weighing Mechanism Description

The weighing mechanism of the F&P gauge is a parallel arm, spring balanced assembly whose free end moves vertically for the no-load to full-load conditions of 0 to 19.9 inches of water. The weighing mechanism shall remain unmodified, except for attachment of the sensor.

3.2.2.2 Required Sensor Functions

The PS shall sense the displacement of the weighing mechanism due to the captured precipitation and shall provide an electrical signal proportional to this displacement at the time of measurement. The sensor performance requirements shall apply not to the sensor alone, but, to the sensor as it is used in the system. The PS/GMA shall maintain these required sensor functions over the whole 0-to-19.9" range of the gauge for any combination of environmental conditions as specified in section 4.

3.2.2.2.1 Accuracy

The PS shall provide repeatable accuracy of the electronic signal sufficient to maintain one-tenth inch (0.1") reports of precipitation for the GMA system between required calibrations.

3.2.2.2.2 Resolution

The PS shall provide sufficient resolution of the electronic indication to maintain reportable increments of precipitation to the hundredth of an inch (0.01").

3.2.2.2.3 Mechanical Motion

An attached sensor shall not hinder, bind, obstruct, limit, or degrade the motion of the weighing mechanism in the areas of accuracy, linearity, repeatability and damping.

3.2.2.2.4 Interchangeability

The PS sensor shall be interchangeable (i.e., must work with any of same type gauge) and shall not require individual site adjustments except for calibration constants.

3.2.2.2.5 Transfer Function

Sensor outputs shall conform to a fixed transfer function. Calibration constants for a sensor may be entered into the system when a sensor is installed.

3.2.2.2.6 Test ability

The PS sensor shall be field testable for operation. Procedures to verify the operation of the sensor shall be included in the sensor documentation and may employ typical electronic technician tools, such as a volt-ohm-multimeter (VOM). Non-direct reading sensors that employ an interface requiring a protocol, shall be testable via the interface.

3.2.3 Temperature Sensor Input

A temperature measuring capability shall be provided with the GMA capable of meeting the temperature accuracy requirements of Table 3.2.3-1.

3.2.3.1 Temperature Sensors Supported

The input shall meet the requirements when used in conjunction with an NWS Maximum/Minimum Temperature System (MMTS) thermistor, or equivalent. The MMTS thermistor is a Vishay/Dale assembly, part no. A-1140, containing an NTC, 20K ohm @ 25C, 0.08% tolerance device.

The GMA shall meet the temperature range requirements of table 3.2.1.2.3-1 below with the following exception: the Dale A-1140 thermistor is not suitable for the -51 to -68 range of the table below, therefore the requirement to report accurately in this range is not required while using the Dale A-1140.

Table 3.2.3-1 Temperature Accuracy Requirements¹ (Celsius)

Operating Range		Accuracy rmse ²	Requirement max error	Resolution
-68	Ta ³ <-51	1.0	+/- 2.2	0.05
-51	Ta <-40	0.5	+/- 1.1	0.05
-40	Ta 44	0.25	+/- 0.55	0.05
44	< Ta 55	0.5	+/- 1.1	0.05
55	< Ta 60	1.0	+/- 2.2	0.05

1 - Accuracy shall be based on a one-minute simple average value. The sensor shall be interrogated at least 6 times/minute to obtain and report a one minute average value.

2 - The period for computations of root mean square error (rmse) shall be one week.

3 - Ta = Temperature(ambient)

3.2.4 Shaft Encoder Input

The GMA shall support a shaft encoder with an incremental, quadrature encoded output as defined in the following paragraphs.

3.2.4.1 Signals

The shaft encoder provides a dual square wave signal on two lines referenced to local ground. The edges of the square waves indicate an increment in the count, and the phase direction (lead or lag) between the square waves indicates the direction of count. The phase angle between the square waves will be 90 +/-10 degrees. The response speed of the shaft encoder is from 0 to 4000 increments/second. The amplitude of the signal will switch between 0.5 and 4.5 VDC, +/- 0.5 VDC.

3.2.4.2 Power

The shaft encoder requires +5 VDC at less than 1 mA. In addition to power, the two signal lines of the shaft encoder are driven by electronic devices with an open collector output that must be pulled high to the +5 VDC supply through resistors, 2.2K ohm typical.

3.2.5 Sensor Cabling

The GMA shall be supplied with a 25-foot, direct burial, shielded cable to support temperature measurements using the NWS A-1140 MMTS thermistor. The cable shall have an AMP 207807-1 connector with the thermistor connections to pins 1 & 3, for connection with the existing NWS MMTS radiation shield connector.

3.2.6 Operator Input

The operator shall be able to select between the following options for display control and subsequent input of information: the default display of current data, display of selectable sensor notations, display for setting time and date, display for selecting units for data on default display.

3.2.6.1 Sensor Notations

The operator shall be able to select from a predefined list of event signifying notations for each sensor defined in the system. Selection of a notation shall enter a uniquely coded, time and date tagged flag into the data record for that sensor. A sensor notation may signify a time-related event that the operator must identify, i.e., start of valid data, or it may signify an informational note, i.e., added oil/antifreeze to gauge. Up to 256 total sensor notations shall be definable for GMA. For defining these notations, see section 3.2.12 Maintenance Port.

3.2.6.1.1 Precipitation Sensor Notations

The following notations shall be predefined and available for selection on the selectable sensor notation display for the F&P gauge: start of valid data, end of valid data, and new zero (for accumulation).

3.2.6.1.2 Temperature Sensor Notations

No notations are identified for this sensor at this time.

3.2.6.1.3 Shaft Encoder Sensor Notations

The following notations shall be predefined and available for selection on the selectable sensor notation display for

the shaft encoder input: start of valid data, end of valid data, and new zero (for level).

3.2.6.2 Set Time and Date

The operator shall be able to set the time and date for GMA.

3.2.6.3 Select Data Units

The operator shall be able to select alternate units for each sensor's data on the default data display. For defining the available units, see section 3.2.12 Maintenance Port.

3.2.7 Display

The GMA shall provide a display capable of displaying output of the three defined sensors at the same time. The display shall show the date, time and current meteorological report from each sensor as the default, and shall label the data if more than one sensor is available.

3.2.7.1 Update Rate

The GMA shall update the display of sensor data at the rate defined in Appendix A and B for precipitation and temperature, respectively, and at a rate definable by the NWS technician under programmable configurations (See 3.2.12.2) for additional sensors.

3.2.7.2 Display Control

The display shall turn on with a switch, or with a push of any operator input button, and shall automatically blank after a setable interval of 1 to 30 minutes.

3.2.7.3 Displayed Sensor Resolution

The display shall show the precipitation data to the hundredth of an inch (0.01") and the units of other data to the resolution defined by the maintenance technician under display control, see section 3.2.12.2.

3.2.7.4 Timeliness of Data

The display shall show the most current meteorological report within five seconds of taking all supporting measurements for the report. See Appendix A and B for the identification of the data item for display and for definition of a report and a measurement.

3.2.8 Logged Data

The GMA shall log the sensor data at a resolution defined under logging control, see section 3.2.12.2. All data shall be logged with date and time stamps to one-minute resolution.

3.2.9 Output Data

The GMA shall format the output data in the format defined in Appendix C, for all outputs. The station identification and equipment configuration information shall be output as ASCII text.

3.2.10 Internal Memory

The GMA shall have sufficient internal memory to accommodate all required software, station identification data, configuration data, and the most current 100 days logged data including, the data defined in Appendix A and B, and the operator notational inputs.

3.2.10.1 Non-Volatile Memory

The GMA shall maintain a non-volatile record of station identification and equipment configuration data for retrieval.

3.2.11 Removable Data Media (RDM)

The GMA shall provide and support a non-volatile, removable, data storage/transport module (RDM) for retrieval of the logged data.

3.2.11.1 RDM Memory

The RDM shall have sufficient memory to accommodate at least a 36-day segment of the internal data logged record in

accordance with Section 3.2.8, and a copy of the station identification and equipment configuration data.

3.2.11.2 Delivered Units

Each GMA shall be supplied with as many RDM devices as required to completely capture the 10-day record stored in internal memory of the GMA, while including a copy of the identification and configuration data on each RDM.

3.2.11.3 Operation

The GMA shall recognize and signal when a RDM is properly inserted into the port, initiate a download, signal when finished downloading data and signify success or failure of the data transfer to the operator. If multiple RDMs are needed to capture the complete data record, the GMA shall provide an operator prompt to select a segment of data for download, or provide a "continue download?" function, (e.g., "Continue with download? Please insert new RDM or XXX to cancel."). Each loaded RDM shall contain the system identification and equipment configuration data as well as a segment of the sensor data.

The GMA shall not require an RDM be installed in its receptacle for complete operation of the GMA, except for those operations involving the upload or download of information to the RDM. For example, removal of the RDM shall not affect data collection and processing, display of the information to the operator, or logging of data to internal memory.

3.2.11.4 Mechanical Characteristics

The RDM shall not rely on a socketed battery for data retention while unpowered. The RDM shall be simple to install or remove from its receptacle, be impossible to insert the wrong way, be mechanically supported by more than the receptacle's connector, and be resistant to dislodging if bumped. The RDM shall be electro-static discharge (ESD) protected to the limits specified in Paragraph 4.0, both when installed, and when removed from the GMA.

3.2.11.5 External Reader

The RDM shall be compatible with PCS either directly, or via an interface or interconnection device/cable. Any hardware required to interface the RDM to a PC, that is not generally available with PCS, shall be provided with the GMA. Any software required to run on the PC to read or download the data from the RDM or control it's interface shall be compatible with Windows 95 or later, and shall be provided with the unit.

3.2.12 Maintenance port

The GMA shall provide a serial port for use in managing programs, data, system configuration, calibration, and maintenance.

3.2.12.1 Port Interface

The maintenance port shall support hardwire direct and modem connections, and be programmable as to baud rate, number of data bits, number of start and stop bits, and parity. The nominal baud rate shall be 9600, and shall be capable of sustaining full duplex communication with a laptop computer located a maximum of 15 meters from the unit at 19,200 baud. The RS-232 interface connector shall be located within easy reach through the open door of the F&P case or on the outside of any external enclosure, and shall be fitted with a tethered, water repellent cap for protection.

3.2.12.2 Programmable Functions

The GMA shall support the following programmable internal functions over the maintenance port: station and sensor identification; input selection, configuration, excitation, control, sampling, scaling and offsets; data manipulation and smoothing; logging control; display control; data output conversion, formatting, and control; optional wireless telemetry control; and operator inputs and controls.

3.2.12.2.1 Notation Options

The GMA shall allow the NWS technician to setup additional choices under the operator input menu that correspond to additional sensors and sensor notations.

3.2.12.2.2 Units and Resolution Definition

The GMA shall provide maintenance technician setup, selectable multiple scale, unit, and resolution capability for display, and separately for output. The default display units shall be: precipitation - inches of water, temperature - degrees Fahrenheit, and shaft encoder - feet. The default output units shall be: precipitation - inches of water, temperature - degrees Celsius, and shaft encoder - feet.

3.2.12.2.3 Clock Control

The port shall support the capability to set the internal clock via remote or locally generated commands.

3.2.13 Local link to the DCOM

When installed with the DCOM, the GMA shall support all command, control and data exchange necessary to support display of current data on the DCOM and download of system and logged data over the DCOM modem to a remote computer.

3.2.14 Power

The GMA shall be powered from a 12 VDC battery.

3.2.14.1 Battery

The battery shall be sized to provide a minimum 30-day operation. The 30 day operation time shall include supporting the wireless link transceiver's power from the GMA whenever the DCOM is present. The battery shall be sealed, support 500 to 1000 recharge cycles, and be available from multiple sources.

3.2.14.2 Recharge

The GMA shall include a solar panel and a battery regulator/charger that will allow battery recharge from either the solar panel or from an Alternating Current supply. The solar panel shall be sized to provide sufficient recharge capability to maintain operation in low sunlight hours areas and seasons.

3.2.14.3 Power Input

The DC power input shall have a water resistant connector on the exterior of any separate GMA enclosure and a disconnection point (terminal block) if inside the F&P case.

3.3 Display and Communications Unit (DCOM)

The DCOM shall include all hardware and software necessary to communicate with the GMA over a wireless link, to retrieve data for display and to send the data over a phone modem to a remote data collection computer.

3.3.1 Location

The DCOM will be located indoors or in an area sheltered from direct precipitation, and shall meet all environmental requirements of section 4, except exposure to rain and freezing rain.

3.3.2 Local Wireless Link

The DCOM shall provide all wireless link equipment for the GMA/DCOM installation. All communication between the GMA and DCOM shall be over the wireless link. The DCOM wireless link shall use modular, spread-spectrum, FCC Part 15, transceivers, antennas and cabling. The transceivers shall be interchangeable to either end of the link, be powered from the GMA or DCOM, and have detachable antennas for use with up to 50 feet of coax cable. The wireless link equipment shall provide an operational range of 500 yards line of sight. The DCOM shall include all software necessary for communication with the GMA to retrieve data and to retrieve self-test information of section 3.3.

3.3.3 Display

The DCOM shall display the current data output of all sensors as the default display. The DCOM shall return to the default display after a user-definable interval. When prompted to display an alternate function, system notification or maintenance actions.

3.3.4 Output of Data

The DCOM shall provide the data, as formatted by the GMA in accordance with section C, via telephone modem as described in accordance with 3.3.6.

3.3.5 Serial Port

The DCOM shall provide an accessible serial port for use in managing programs, data, configurations, and maintenance.

3.3.6 Telemetry

The DCOM shall provide and support a telephone modem. The modem communications capability shall be programmable as to baud rate (1200 minimum), number of data bits, number of start and stop bits, and parity.

The DCOM shall support initiation of data transfers under the following modes: a) remote initiated dial-in, and b) local activated dial-out control. The local activated dial-out control shall support: a) initiation of call in response to commands from a technicians laptop connected to another port, b: a call directed by GMA or DCOM functions and c) a special local operator control. The DCOM shall provide a special local operator control that is an always ready, one button or menu item, dial-out function to initiate a modem call and transfer the station information and logged data to a pre-defined phone number. The technician shall be able to define this phone number and data transfer parameters when setting up the instrument.

The DCOM shall provide status of the calls and data transfers to the operator, and as a minimum shall indicate successful completion of a data transfer.

3.3.7 Power

The DCOM shall operate from 115 VAC, 60 Hz power and shall require less than 500 watts of power.

3.3.8 Size

The DCOM shall be a maximum of 18"x 18"x 18".

3.4 Self Test

The GMA and DCOM shall provide two classes of tests: built-in self-tests that run continuously to verify operation of the hardware, and off-line diagnostic tests that are executed on demand in response to an external command via the maintenance port for calibration and off-line diagnostic procedures.

3.4.1 Built-in Self Tests

The self tests shall be capable of detecting and accurately reporting 95% of all hardware faults which adversely impact system performance. Self tests shall not interfere with the collection, processing, storage or reporting of data. Examples of areas which may be tested for failure or out of tolerance conditions as required to meet the 95% confidence factor may include but are not limited to:

- AC and DC Power supplies, batteries,
- Processing elements,
- Hardware elements, and sensors
- Memory elements,
- Read Only Memory (ROM) checksum,
- Communications ports,
- Connectivity of modular elements (i.e. sensor to data logger, RF link),
- Electronics enclosure internal temperature, and
- Heater circuitry (if applicable),
- Voltage references .

3.4.2 Diagnostic Tests

Calibration of the F&P weighing mechanism uses a procedure supported by a set of external weights to establish the zero and full-scale endpoints, and to test sensitivity and

intermediate weights. The GMA shall incorporate and support an independent operational verification and calibration mechanism to align the F&P sensor with the response of the F&P weighing mechanism. The sensor verification and calibration mechanisms may use a laptop computer for display and input of calibration parameters, the F&P calibration weights already in use by the NWS, general technician hand tools and a VOM. Any other tools, fixtures, or hardware shall be supplied with the GMA for use with the gauge at installation.

Off-line diagnostic procedures shall be provided for those faults that cannot be detected by the built-in self-test or are too time intensive to be practical for on-line testing. Off-line diagnostic tests shall provide dialogue and feedback to the maintenance technician.

3.5 Software Requirements

3.5.1 General

The GMA software shall provide a menu-driven configuration capability through a high-level configuration language and shall not require the generation of source code.

The GMA and DCOM's operating and configuration software shall be provided in executable object code on media appropriate to a PC and shall support installation, data recovery, configuration generation, and program/configuration/data backup functions from a PC over a direct serial, or modem connection. The backup function shall support both archival and restoration of all necessary files and data. necessary to record a system operational baseline and to restore the system to that baseline. Restoration of the backup baseline shall be sufficient to run the system normally without change.

The system shall recover from a power failure automatically within 30 minutes of reapplication of power, with no human intervention required, and shall restore full operation using the most recent configuration settings. Any external software required for the GMA's or DCOM's operation and maintenance shall be supplied with the system and shall execute under Windows 95 or later. All software shall be supplied with licenses appropriate to allow the Government without restriction to reproduce, distribute and use unlimited copies within NWS for use with this program.

The GMA operating software shall be field upgradeable without having to remove/replace storage devices.

3.5.2 Algorithms

The embedded software shall implement the data processing algorithms as defined in Appendices A, B and C of this document and shall provide for storage and archive of raw, processed and reported sensor data.

3.5.3 Security

The system shall provide access protection for all modem dial-in connections.

3.6 Hardware Requirements

3.6.1 Clock

The GMA and the DCOM shall have an internal clock accurate to +/- 2 min/month.

3.6.2 Cables

The GMA and the DCOM shall be delivered with all power, grounding, and signal cables as part of the unit.

3.6.3 Connectors

Each cable supplied with the GMA and the DCOM shall have connectors on both ends. All outdoor cable connectors shall include a strain relief, a seal for the mating surfaces and a seal for the wire entry area.

The external chassis connectors on the GMA and the DCOM shall be sealed, or water-blocked or shall use a wire-to-connector-body gland, membrane or potting. The chassis connectors shall be corrosion compatible with the enclosure surface to which it is mounted. All spare connectors and test connectors shall be provided with moisture resistant dust covers.

3.6.4 Design and Construction

The GMA and the DCOM shall be labeled, identifying conformance to Federal Communications Commission (FCC) Part 15, Radio Frequency Devices, and Part 68, Connection of Terminal Equipment to the Telephone Network, rules and regulations as applicable.

The GMA's and the DCOM's design and construction shall prevent incorrect insertion by keying circuit cards/modules, and use restraining devices for plug-in circuit cards/modules.

The GMA's and the DCOM's enclosures shall be made entirely of suitable corrosion resistant materials that will permit storage and use in the natural weather conditions of an outdoor environment and be able to withstand routine exposure to accidental spills, seacoast or salt-laden humid environments, sunlight and extreme temperatures without damage from corrosion, the environment or deterioration of material with age. The GMA and the DCOM shall use enclosures made of a material that shall be resistant to corrosion, constructed with fasteners and hardware that do not corrode and are compatible with the base material of the enclosures. The enclosures shall seal and protect components from intrusion, damage or functional degradation by animals, birds, and insects. Penetrations shall be on the bottom of the outdoor enclosures. All external steel parts including poles shall be 304 grade or better stainless steel mounting hardware, enclosures and exposed hardware (unless otherwise specified).

All painted items shall use a finish impervious to the environment, including the effects of solar radiation, and shall be resistant to chipping, flaking, or chalking when being handled or transported. Prior to painting, any aluminum surface shall be chemically treated (iridited).

System electronics shall be protected from transients and power variations as necessary to meet the requirements of section 4.1 of this specification.

System design and construction shall include provision for grounding the shields on either end of the cables, provide shield grounding for connections to the power line ground wires, and configure power and signal returns to permit single-point grounding.

3.6.5 Workmanship

The GMA's and the DCOM's assembly and workmanship shall be accomplished in such manner so as to avoid damaging the hardware or the mounting surface. Assembled equipment shall be free of spattered, or excess solder, weld metal; metal chips and mold release agents or any other foreign material which might detract from the intended operation, function, or appearance of the equipment, including any particles that could loosen or become dislodged during normal equipment life expectancy. All corrosive material or agents shall be removed, and parts and assemblies cleaned before installation into the equipment.

The GMA's and the DCOM's assembly and workmanship shall show no evidence of cross-threading, mutilation, or hazardous burrs on screws, nuts and bolts. All screw-type fasteners shall be firmly secured so that no relative movement is possible between the attached parts.

Bearing assemblies shall be clean and free of rust, discoloration, and imperfections on all ground, honed, or lapped surfaces, and all contacting surfaces shall be free of tool marks, gouge marks, nicks, or other surface-type defects. Any detrimental interference, binding, or galling shall be identified and corrected.

Wherever practicable any insulated wire running between equipments shall be formed into cable bundles or ducts. Wires and cables shall be positioned or protected to avoid contact with rough or irregular surfaces, and sharp edges or interference with mechanical operations that may lead to damage. Cable lacing shall be neat in appearance and applied firmly, yet not with excessive pressure which could cut into wire insulation. Wires and cables subject to flexing shall be restrained with anchors and protection to prevent abrasion. Wire layout shall eliminate burrs, abrading, or pinch marks in the insulation that could cause short circuits or leakage. Wires shall be continuous between two terminals. Wire splices shall not be acceptable.

Shielding on wires and cables shall be terminated in a manner that will prevent contacting or shorting of exposed current-carrying parts, and secure the ends of the shielding or braid against fraying.

3.6.6 Power and Grounding

The GMA and the DCOM shall be installed in accordance with NFPA 70 for all Alternating Current commercial power inputs.

The GMA and the DCOM shall have an external safety ground stud to serve as the common tie point for static and safety grounding, and shall be designed and constructed to ensure that all external parts, surfaces, and shields are at ground potential at all times during normal operation.

The GMA and the DCOM shall be constructed so that any external or interconnecting cable, where a ground is part of the circuit, carries a ground wire in the cable, terminated at both ends in the same manner as the other conductors. Shields shall be terminated at one end only, as appropriate to maintain shielding effectiveness.

Except with coaxial cables, the GMA and the DCOM shall not use the shield for a current-carrying ground connection, and shall not use ground connections to shields, hinges, and other mechanical parts to complete electrical circuits.

The GMA and the DCOM shall have ground connections to an electrically conductive chassis or frame mechanically secured by soldering to a spot-welded terminal lug or to a portion of the chassis or frame that has been formed into a soldering lug, or by use of a terminal on the ground wire and then securing the terminal by a screw, nut, and lock washer.

The GMA and the DCOM shall have the metal around the ground lug screw hole plated or tinned to provide a corrosion resistant connection, when the chassis or frame is made of steel, or have the metal around the ground lug screw or bolt covered with a corrosion resistant surface film (resistance through the film shall not be more than 0.002 ohm) when aluminum or aluminum alloys are used .

The GMA and the DCOM shall use a point on the electrically conductive chassis or equipment frame to serve as the common tie point for static and safety grounding. The path from the tie point to ground shall: Be continuous and permanent, have ample carrying capacity to safely conduct any fault currents that may be imposed upon it, have impedance

sufficiently low to limit the potential above ground and to facilitate operation of the over-current device in the circuits, and have sufficient mechanical strength to minimize the possibility of ground disconnection.

3.6.7 Electrical Connectors Assembly

The GMA and the DCOM's electrical connectors shall be assembled with tooling as specified by the connector manufacturer. However, tooling as recommended by the contact or tooling manufacturer may be used provided that the finished electrical connection meets all of the performance requirements of the contact and connector specification.

3.6.8 Moisture Pockets

The GMA and the DCOM shall be designed and constructed such that pockets, wells, traps, and the like in which water or condensate could collect when the equipment is in normal positions are avoided. Where moisture collection is unavoidable and that portion of the equipment is not sealed, the GMA and the DCOM shall have drains for removal of moisture to the outside.

The GMA and the DCOM shall not use desiccants or moisture-absorbent materials within moisture pockets, but may use desiccants to remove trace levels of moisture in elements of the equipment which are sealed against the environment.

3.6.9 Transient and Lightning Protection

The GMA and the DCOM shall be protected against damage or operational interruptions due to lightning-induced surge on all sensor input lines, sensor supply lines, incoming power and communications lines to the limits specified in paragraph 4.1, Table 4.1-4 POWER AND SIGNAL LINE LIMITS.

3.6.10 Electrostatic Discharge Requirement (ESD)

The GMA and the DCOM shall not require special ESD handling requirements when all covers and doors are in place, and shall have appropriate ESD warning labels affixed to the outside of the unit, easily visible to maintenance personnel, should the unit use ESD sensitive components in the design and construction.

4.0 ENVIRONMENTAL REQUIREMENTS

The GMA equipment shall operate when mounted in an unsheltered/exposed location, over the whole range of environmental conditions experienced in any location in the United States and its territories, and shall meet the conditions defined in this section, outdoor environment.

The DCOM shall meet the same requirements as the GMA, except that rain and freezing rain requirement shall not apply.

4.1 Operational Environment

The GMA shall be designed to operate in the outdoor environment 24-hours-a-day, 365-days-a-year.

The equipment shall be sufficiently rugged such that conditions incident to normal shipping over long distances involving air and surface transport, installation, use and service shall not affect serviceability, accuracy or stability.

The most severe operating environmental parameter shall prevail in determining equipment specifications. Tables 4.1-1 through 4.1-4 lists the range of required outdoor, transportation, storage, power and signal line environment limits under which the system shall operate accurately and withstand without damage. These limits have been taken from the NWS Standard Environmental Criteria and Test Procedures (WS-STD-2) and the NWS Transient Susceptibility Standard (EHB 3-11A).

The equipment shall operate without degradation of reported data and shall meet all requirements of this specification when installed in any combination of the following environments:

- a. Temperature Extremes - exposure to the range of temperatures defined in Table 4.1-1 of this document. Temperatures may be sustained for an extended duration, at the high and low extreme operating temperatures. Temperature instability can continuously subject the unit to temperature shock.
- b. Solar Insolation - exposure to heat build-up from solar

or radiation levels as defined in Table 4.1-1 of this document. Exposure to severe bright sunlight for 10 more hours-per-day.

- c. Dust/Pollen - continuous exposure to wind driven respirable pollen and dust as defined in Table 4.1-1 of this document for a minimum of 100 continuous days-per-year.
- d. Salt/Fog - exposure to severe marine environment containing the maximum salt solution as defined in Table 4.1-1 of this document. This exposure can be continuous for 365-days-per-year, or can be interspersed with periods of varying humidity and temperature.
- e. Rain - exposure to continuous rain intensities as defined in Table 4.1-1 of this document. Rain may be in the form of continuous wind-driven rain.
- f. Freezing Rain - exposure to severe ice accretion as defined in Table 4.1-1 of this document. Ice and frost build-up may be extensive and may be near-continuous.
- g. Wind - exposure to severe winds and gust as defined in Table 4.1-1 of this document.

Table 4.1-1 ENVIRONMENTAL LIMITS

Environmental Condition	Operational Test Limit	Withstanding Test Limit	Test Procedure
High Temperature	50C	60C	1
Low Temperature	-60C	-70C	2
Temperature Shock	20C/-50C 30C/+50C	20C/-62C 30C/+55C	3
Temperature Cycling	40C/5C@20%RH 10C/-18C@60%RH	same as op	4
Humidity (non-condensing)	35C@74%RH to 30C@100%RH	45C@45%RH to 35C@100%RH	5
Wind (Steady)	to 30 kts	to 73 kts	6
Wind (Gust)	to 46 kts	to 125 kts	6
Rain	to 7.5cm/hr with 30 kts wind	to 12.5cm/hr with 73 kts wind	7
Freezing rain	ice accretion to 2.5cm with 20 kts wind rate: 1.3cm/hr	ice accretion to 7.5cm with 35 kts wind	8
Dust	176 mg/cu.meter with 3-5 kt wind @50C, <25%RH 100 micron particles	same as op	9
Insolation (Sunshine)	heat build-up when exposed to 968 watts/sq.meter @ 50C	heat build-up when exposed to 1118 watts/sq.meter @ 55C	10
Low Pressure	to 596 hPa	180.5 hPa	11

1. Referenced test procedures above are sections contained in the document WS-STD-2; "NWS Standard Environmental Criteria and Test Procedures" .

Table 4.1-2 TRANSPORTATION/STORAGE ENVIRONMENT LIMITS

Environmental Condition	Environmental Limit [Item(s) Packaged in Shipping Containers]	Test Procedure
High Temperature	60C	1
Low Temperature	-65C	2
Humidity non-condensing	to 100% RH @ 29C	5
Rain	to 7.5cm/hr. with 30 kts wind	7
Low Pressure (altitude)	180.5 hPa (12190 meters)	11
Vibration	Transit via common carrier, unrestrained cargo 3-5 Hz, 1g acceleration, 1" displacement, 30 minute each face	12
Handling	Transit Shock, to 54.3cm drop, See Table 4.1-3 "Height Of Drop Limits"	13

1. Referenced test procedures above are contained in the document "NWS Standard Environmental Criteria and Test Procedures," WS-STD-2.

Table 4.1-3 HEIGHT OF DROP LIMITS

Gross weight not exceeding faces	Dimensions of any edge, height, or diameter not exceeding	Free-fall height of drop on corners or edges, or flat
Kilograms	Centimeters	Centimeters
25	94.6	54.3
50	128.2	39.6
75	152.4	34.0
100	160.7	29.1

Table 4.1-4 POWER AND SIGNAL LINE LIMITS

<u>Environmental Condition</u>	<u>Operational Test Limit</u>	<u>Withstanding Test Limit</u>	<u>Test Procedure</u>
AC Power Line variations			
a) Voltage	115 VAC +/-10% (change in 2 sec between limits over 3 hr period)	115 VAC +/-20% (change in 2 sec. between any level over 3 hr period)	Contractor developed procedures
b) Frequency	60 Hz +/-3.0 Hz (change in 2 sec between limits over 3 hr period)	60 Hz +/-5.0 Hz (change in 2 sec. between any level over 3 hr period)	Contractor developed procedures
Power interruptions	power loss any length, operation returns to normal afterwards	Same as operational	Contractor developed procedures
Electrostatic discharge	Non-controlled environment with 15,000 volts Test Level I with acceptance criteria *Para. 3.3 (a). No upset.	Same as operational	*Para. 4.4.2
Power and signal line transients			
a) Power line	Test Level I with acceptance criteria * Para. 3.3 (a) No upset.	Same as operational	*Para. 4.2
b) Signal line	Cross talk and lightning tests Test Level I with acceptance criteria *Para. 3.3 (a). No upset.	Same as operational	*Para. 4.3

* NWS Transient Susceptibility Standard, May 1978

5.0 LOGISTICS

5.1 Maintainability

A primary requirement of the system will be high availability and accuracy of reported data.

5.1.1 Mean Time to Repair (MTTR)

The GMA and DCOM shall have a demonstrated MTTR which is less than 30 minutes at a 95% confidence level. The MTTR shall include the time required to fault detect, fault isolate, remove and replace the failed lowest repairable unit (LRU) and perform a checkout and any necessary calibration of the subsystem to return the equipment to operation.

5.1.2 Calibration and Preventive Maintenance

Preventive maintenance and calibration shall not be required more frequently than once every 180 days to maintain operation such that the specification and calibration requirements are met. This specifically includes maintenance needed to clean or service sensor probes, optics, orifices, or any element of the system.

5.1.3 Spare Parts Availability

The contractor shall maintain spare parts availability for twelve years after acceptance of the production units. The spare parts availability implies that the contractor will continue to produce or provide functionally identical replacement parts which will be compatible with the units. In the event that part obsolescence is identified for which there is no viable alternate part, the contractor shall provide a 6-month written notice to the Government to allow a lifetime purchase of parts should the Government choose to do so. The replacement parts shall meet or exceed the original specification.

5.2 Reliability

5.2.1 Operational Availability Requirements

The GMA and DCOM shall have a demonstrated operational data availability of 99.5% with a logistical delay time of 48

hours for arrival of a technician. The reported data shall be classified as correct when the reported information is within the accuracy and resolution required by this specification. For purposes of demonstrating operational availability, no outage time will be ascribed to errors caused by routine scheduled maintenance activities, provided that it is required no more frequently than the preventive maintenance interval specified in this specification.

5.2.2 Mean Time Between Failure (MTBF)

The units shall have a demonstrated hardware MTBF in excess of 10,000 hours while operating in the most severe ground-fixed environment as described in sections 4.0 and following.

5.2.3 Reliability Prediction

For those elements of the system which do not have reliability specifications derived from actual operation in the field, the Contractor shall develop a reliability prediction. This prediction shall be based upon the data in MIL-HDBK-217 and shall assume an ambient temperature condition of 40 degrees Celsius.

6.0 DOCUMENTATION

6.1 General Requirements for Technical Manuals

Technical manual(s) which support the operation, maintenance and diagnosis to the LRU level of the units and which provide the information specified in the following subparagraphs shall be provided. The manual(s) shall also contain all necessary warnings, cautions or notes to avoid personal injury or damage to the equipment.

6.1.1 Introduction

The manual(s) shall contain line illustrations which clearly identify all LRUs within the units.

6.1.2 Installation

The manual(s) shall contain line illustrations which clearly illustrate how to properly install the GMA and the DCOM. A step-by-step procedure shall be provided which specifies how to remove each unit from its shipping cartons and how to properly install them, including calibration if required. Mounting hardware and torque specifications, computer interface requirements and power requirements shall also be provided.

6.1.3 Operation

The manual(s) shall contain step-by-step operation and configuration procedures. These procedures shall contain, but are not limited to, power on/off, normal operation and diagnostic procedures. The manual(s) shall also contain detailed information on maintenance interface requirements, including initialization, commands, responses and formats.

6.1.4 Theory of Operation

The manual(s) shall contain basic block diagrams and detailed block diagram theory for all major functions of the units, including power distribution. The functional diagrams shall provide enough information for the user to make electrical connections between assemblies, chassis, bays, units, and systems during installation, assembly/disassembly, modification, or service. Functional drawings should be supplemented with interconnection diagrams, wire data lists, and schematics to meet this requirement.

6.1.5 Imbedded Algorithms

The manual(s) shall also contain a detailed description of any imbedded processing algorithm.

6.1.6 Maintenance

The manual(s) shall contain all preventive and corrective maintenance procedures required for field-level maintenance of the units. This information shall consist of a preventive maintenance schedule along with detailed procedures which explain each preventive maintenance task. All items required for preventive maintenance shall be listed stating the part number and manufacturers. The corrective maintenance procedures can be automatic or manual but must isolate

failures to the LRU. Detailed calibration procedures shall be provided as required. Step-by-step removal and installation procedures shall be provided for all LRUs.

6.1.7 Parts List

The manual(s) shall contain a parts list of all LRUs within the units. This list shall include: Item Name, Agency Stock Number (ASN), Federal Manufacturer's Code, and Contractor's Part Number.

6.1.8 Drawings

The manual(s) shall contain, in bound form, all oversized drawings: i.e., loose drawings are not acceptable. These drawings shall include interconnect diagrams with connector information, functional block and signal flow diagrams, and physical to logical (i.e., external P5-pin3 = internal analog voltage channel 6A) diagrams. The drawings shall focus on hook-up and configuration, and on trouble-shooting and repair at the LRU level.

7.0 WARRANTY

Each unit, stored in the Contractor-provided shipping container, will be installed within 12 months from acceptance by the Government. The Contractor shall warrant the hardware and software for one year (twelve months) after equipment installation.

7.1 Repairable Parts

Should any defect occur during the warranty period, the defective part or instrument shall be repaired or replaced without cost to the Government. The Contractor shall be responsible for all transportation and packaging charges for all warranty repairs to/from the NWS National Logistics Supply Center (NLSC), in Kansas City, MO.

8.0 UNIT IDENTIFICATION

The Contractor shall identify each LRU with a permanent nameplate, label, or markings, containing the following

equivalent information: manufacturer's name or symbol, manufacturer's model number, part number, revision number, and serial number. To support Government logistical operations, the following definitions apply:

- manufacturer's name or symbol - a name or symbol that identifies a source of a replacement item.
- manufacturer's model number - a name or number that identifies the item to a generic class or group of similar items.
- part number - a specific name/number that identifies this item and its functionality as distinct from all other similar, but slightly different, items. This number shall be the number used to order an exact replacement.
- revision number - a number that identifies the revision of the item. Any change to the item in its manufacture, programming, or function, shall require a new revision number. The revision number/information may be a part or sub-part of the part or serial number and shall be identified to the Government.
- serial number - a number that identifies one and only one unit of all similar model/part/revision numbered units.

8.1 Agency Stock Number Assignment and Marking

Each LRU will be assigned an Agency Stock Number (ASN) by the NWS. The Contractor shall identify each unit with a permanent nameplate, label, or markings, containing the assigned ASN. The ASN shall be visible on the exterior of an individual unit without having to open or disassemble anything on that unit. On LRUs that are installed within other units, the ASN shall be readable on the installed LRU, when the LRU is viewable.

APPENDIX A

A.1 Precipitation Algorithm

The value obtained from the sensor shall be processed to represent inches of liquid water with 0.01 inch resolution.

The text algorithm description is presented for guidance in developing NWS desired reported data from sensor measurements. The text algorithm defines the actions, processes and outputs that NWS considers important. The NWS recognizes that equipment may use system processes and structures that do not lend themselves to exact implementation of the text algorithm description. Data labels are used in the description below to enhance understanding and are not required as part of the data in the implementation.

- Every 10 sec (or faster) obtain a measurement from the sensor. Place the value in intermediate storage. Update the displayed "Current" report on the local display.
- Each minute, at the top of the minute, compute the average one minute weight (P1m). Time and date stamp P1m and place into intermediate storage. If a data request for the "Current" report is made from a remote user (via modem or port), use the last P1m.
- Each quarter hour, starting at the top of the hour, average the last 5 P1m's, archive the value with a date and time stamp into internal memory, as P15m.
- Each 24 hours, at the hour entered by the technician as "Time of Observation, Precipitation", at the top of that hour, archive the current P15m value with a date and time stamp into internal memory, as P24h. Calculate the difference between the current P24h and the last P24h and archive the difference value with a date and time stamp into internal memory, as P24d. Display P24d for the observer, if requested.

If no hour has been entered by the technician for "Time Of Observation, Precipitation" use 12 midnight, LST as a default.

A.2 Variable Definitions

P1m = Weight of precipitation in the gauge at time of measurement, one-minute interval, averaged value

P15m = Weight of precipitation in the gauge at time of measurement, 15-minute interval, 5 minute averaged value

P24h = Weight of precipitation in the gauge at end of identified 24 hour period, 15 minute interval, 5 minute averaged value

P24d = Difference in Weight of precipitation in the gauge at beginning and end of identified 24 hour period

APPENDIX B

B.1 Ambient Temperature Algorithm

The value obtained from the sensor shall be processed to represent degrees Celsius with 0.05 degree Celsius resolution.

The text algorithm description is presented for guidance in developing NWS desired reported data from sensor measurements. The text algorithm defines the actions, processes and outputs that NWS considers important. NWS recognizes that equipment may use system processes and structures that do not lend themselves to exact implementation of the text algorithm description. Data labels are used in the description below to enhance understanding and are not required as part of the stored data in the implementation.

- Every 10 sec (or faster) obtain a measurement from the sensor. Place the value in intermediate storage. Update the displayed "Current" report on the local display.

- Each minute, at the top of the minute, compute the average one- minute temperature (T1m). Time and date stamp T1m and place into intermediate storage. If a data request for the "Current" report is made from a remote user (via modem or port), use the last T1m.

- Each hour, at the top of the hour, examine the T1ms for the last hour, and:

1. Find the highest temperature, archive the value with its date and time stamp into internal memory, as Thmax.

2. Find the lowest temperature, archive the value with its date and time stamp into internal memory, as Thmin.

3. Archive the last T1m with its date and time stamp into internal memory, as Th.

- Each 24 hours, at the hour entered by the technician as "Time of Observation, Temp", at the top of that hour, examine the last 24 hours of data and:

1. Find the highest temperature from the Thmaxs, archive the value with its date and time stamp into internal memory, as Tdmax.

2. Find the lowest temperature from the Thmins, archive the value with its date and time stamp into internal memory, as Tdmin.

If no hour has been entered by the technician for "Time Of Observation, Temp" use 12 midnight, LST, as a default.

B.2 Variable Definitions

T1m	=	Ambient temperature one-minute average value from the Temperature Sensor
Th	=	Ambient temperature one-minute average value at the top of the hour
Thmin=		Minimum T1m during the most recent one-hour period
Thmax=		Maximum T1m during the most recent one-hour period
Tdmin=		Minimum T1m during the designated 24-hour period
TDmax=		Maximum T1m during the designated 24-hour period

APPENDIX C

This section defines the format and structure of commands and data when accessed through the serial port or modem.

C.1 Report Format

The polling command strings shall be defined in the technical manuals. At least three distinct polling messages shall be supported - one for meteorological data, one for the historical record of meteorological data, and one for configuration data. Data and maintenance polling command strings shall only require ASCII characters that can be entered on a PC keyboard.

Output units shall be selectable by the technician under setup of the unit.

When polled for meteorological data, send the most recent archive from all sensors in the current system configuration via the polled port using comma separated value (CSV), in a general, fixed, format that includes: station identification and ID in a header, followed by value, date and time tag for each logged parameter.

When polled for the historical record of meteorological data, send the most recent archive from all sensors first, followed by the successively older data, via the polled port using CSV format in a general, fixed, format that includes: station identification and ID in a header, followed by value, date and time tag for each logged parameter.

When polled for configuration data, send the GMA and DCOM configuration data to the polling computer in CSV format and include: the site ID; the unit serial number; the identity of each sensor, its serial number and sensor status codes; and the identity of any intelligent LRUs, the LRU serial number and any status codes. A highly desirable feature would be to date/time tag a record of any change in configuration or sensor/system status in a downloadable system log file.

Default unit selection for the polled string values are defined in section 3.5, unless otherwise selected. Archived data shall be stored in default units. All data shall be

formatted and transmitted as an ASCII string. The exact format of the message, as well as the method to ensure data integrity (checksum, parity, answer back, etc), shall be documented in the technical manuals.

Acronyms

National Weather Service (NWS)	5
Fischer and Porter/Belfort (F&P)	5
Weather Service Operations Manual (WSOM)	5
National Fire Protection Association (NFPA)	6
gauge modification assembly (GMA)	8
display and communication (DCOM) units	8
precipitation sensor (PS)	10
volt-ohm-multimeter (VOM)	11
Max/Min Temperature System (MMTS)	12
root mean square error (rmse)	12
Removable Data Media (RDM)	15
built-in self-tests (BIT)	20
Read Only Memory (ROM)	21
Federal Communications Commission (FCC)	23
Electrostatic Discharge Requirement (ESD)	27
Mean Time to Repair (MTTR)	32
Mean Time Between Failure (MTBF)	33
Agency Stock Number (ASN)	34
National Logistics Supply Center (NLSC)	35
comma separated value (CSV)	41